

Answer the following questions. You may assume any missing data.

**Question 1:**

- Explain each of the following statements: "An OS is a government" and "An OS is interrupt driven"
- What is a system call? What is the purpose of system calls, and how do system calls relate to the OS and the concept of dual-mode (kernel mode and the user mode) operation?
- Consider the various definitions of *operating system*, such as Web browsers and mail programs. Argue both that it should and that it should not, and support your answer.
- What are the main steps in a DMA transfer? How can DMA increase system performance? How does it complicate the hardware design?

**Question 2:**

- Discuss the storage structure in a system. Show how storage systems can be organized in a hierarchy.
- Suppose a disk drive has 5000 cylinders, numbered 0 to 4999, the drive is currently serving a request at cylinder 500, and the previous request was at cylinder 300. The queue pending requests, in FIFO order, is: 220, 300, 1500, 2000, 600, 4000, and 2500. Starting from the current head position, what is the total distance (in cylinders) that disk arm moves to satisfy all the pending requests, for each of the following disk scheduling algorithms: (i) FCFS (ii) SCAN (iii) LOOK.
- Consider the following set of processes, with the length of the CPU-burst time given in milliseconds.

Process	Arrival Time	CPU Burst Time
P1	0	10
P2	120	20
P3	20	30
P4	10	10
P5	50	50

Process	Arrival Time	CPU Burst Time	Priority
P1	0	10	10
P2	120	20	3
P3	20	30	8
P4	10	10	7
P5	50	50	4

Draw three Gantt charts illustrating the execution of the processes using FCFS, a preemptive SJF, and a preemptive priority (assume Linux) scheduling. Which of the above schedulers results in the minimal average waiting time?

**Question 3:**

- What is a process? What is a thread? What are the main advantages of multithreading?
- Draw the thread state transition diagram and indicate the transition that causes each transition of JVM thread model.
- Write a multithreaded Java program that outputs  $Z = \frac{1}{N} \sum_{j=1}^M \left| \bar{X} - \bar{Y} \right|$ , where  $M$  and  $N$  are positive integers,  $\bar{X}$  is the average of  $X$ s and  $\bar{Y}$  is the average of  $Y$ s. The computation of  $Z$  should be done by two concurrent threads, each computing only one partial result. The program should work as follows: the user enters a positive integer  $N$ , the values of  $X$ , and the values of  $Y$ . Finally, the primary thread outputs the values of  $Z$ .

**Question 4:**

- What are the major activities of an OS in regard to process management?
- What is the meant by "File System"? Give a short comparison among FAT32, NTFS, and HPFS.
- It is required to write a Java program that simulates the tick of a clock by displaying the words "tick" and "tock" on the screen. To accomplish this, write a class `TickTock` that contains two methods: `tick()` and `tock()`. The `tick()` method displays the word "tick" and the `tock()` method displays the word "tock". To run the clock, two threads are created, one that calls `tick()` and one that calls `tock()`. The goal is to make the two threads execute in a way that the output from the program displays a continuous pattern of "Tick Tock" — that is, a repeated pattern of one tick followed by one tock.

Best Wishes

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Faculty of Engineering  
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3rd year final exam 3 / 6 / 2007  
Electronic Measurement Systems  
Time allowed: 3 Hours

**\* Answer all the following questions:**

- Q1: a) Explain with diagram the principle operation of basic Liquid Crystal Displays (LCD).  
b) What are the additions to basic LCD in order to produce large area displays with sufficient brightness and contrast ratio?  
c) What are the additions to basic LCD in order to produce colour displays?
- Q2: a) Explain with diagram the principle operation of black and white laser printer.  
b) From your point of view, what are the additions to laser printer in order to become a laser colour printer?  
c) Explain with diagram the principle operation of chart recorder. What are the types of multi-channel recorder?
- Q3: a) Explain briefly the main types of common optical sources?  
b) Explain with diagrams the differences between reflection and refraction of light?  
c) When reflection happens?
- Q4: a) Explain how Pulse-echo technique can be used for metal thickness determination and discovery of the presence of internal defects.  
b) What are the conditions which should be obeyed by the transmitted pulse signal?  
c) What are advantages and disadvantages of Pulse-echo compared to TOFD technique?
- Q5: a) What are the even harmonics?  
b) What is the duty cycle?  
c) Plot the circuit diagrams of base clipper and slicer circuit.

My Best Regards

Dr. Osama Zahran